Nova Scotia

Department of Mines and Energy

OFR 86-039

AGRICULTURAL GYPSUM PROJECT

by

Peter Luke

Mineral Development Division

Nova Scotia Department of Mines and Energy

Halifax, Nova Scotia

April, 1986

AGRICULTURAL GYPSUM PROJECT

Objective:

To promote the use of gypsum as an agricultural fertilizer and as a soil amendment to various persons in the Northeastern United States in hopes of establishing a new export market for Nova Scotian produced gypsum products.

Step 1:

The first step was to gather information on the use of agricultural gypsum. Contacts were made with numerous university scientists and research center directors working in the field of agronomy or soil science and who have performed soil experiments with gypsum. Papers were requested and received from the scientists and institutions listed below. Also library research was performed at Dalhousie by myself and at Nova Scotia Agricultural College in Truro by Ms. Bonny Waddell. Almost fifty papers have been gathered, read and filed. A bibliography was also prepared and stored in the Department's micom for additions and changes.

Information was provided by:

Karen Simmons - University of Wisconsin, Soil Science Department

Dr. Jim Oster - University of California at Riverside, Soil and Environment Department

Mike Lloyd - Florida Institute of Phosphate Research

Sulphur Institute - Washington, D. C.

Step 2:

A "gypsum promotional package" consisting of the bibliography, specification data on the agricultural gypsum product available from Mosher Limestone, and reprints of seven papers selected from the bibliography was compiled. These papers (listed below) are of particular significance considering the identified market area's climate, crop types, and soil conditions.

Simmons	Use of Supplemental Calcium on Potatoes
Shanmuganathan & Oades	Modification of Soil Physical Properties by Addition of Calcium Compounds
Hinds	Effect of Gypsum on Yield of Kennebec - A Mid-Season Potato Cultiver
Sharma, Fehrenbacher & Jones	Effect of Gypsum, Soil Disturbance and Tile Spacing on the Amelioration of Huey Silt Loam, a Natric Soil in Illinois
Hignett & Stangel	Agricultural Sulphur in the Americas
Hinds & Ghanem	High Limestone Applications on Eroded Podzols in New Brunswick

Step 3:

Telephone calls were made to persons in the Agriculture Departments for the States of Vermont, New Hampshire, Connecticut and Rhode Island. Use of agricultural gypsum in each state was discussed with the State Representatives listed below and information packages sent to them, requesting that they forward this information to interested parties. Mr. Bill Johnson of Lee Lime at Lee, Massachusetts was also contacted. Mr. Johnson is director of the New York State Lime Producers Board and is very interested in Nova Scotia agricultural gypsum.

Agriculture Department Contacts:

Jeff Comstock -	Vermont, Plant Division
James Cassidy -	Mass., Food & Agriculture Division
Ken Veit -	Conn., Food & Agriculture Division
Steve Volpe -	Rl, Food & Agriculture Division

Step 4:

Agricultural gypsum was to be discussed at the New York Lime Producers meeting held March 24-26, 1986. If Mr. Johnson maintains his enthusiasm and if a local agricultural gypsum producer decides to pursue this effort to its utmost, there is excellent potential to develop a new gypsum market.

Initially this should be attempted through Lee Lime, a company which supplies fertilizer throughout all the northeastern states. If this connection does not develop, then local producers might consider preparing their own promotional material and pursuing the market through other fertilizer companies.

CONTACTS

Research Contacts:

Paul Andrelinas	(202)786-1457	U.S. Dept. of Agriculture, Washington
Ronald Follett	(303)226-9425	Agriculture Research in Colorado
Witt Yelverton	(202)861-4921	Fertilizer Institue, Washington
James Samples	(206)386-2201	National Fert. Dev. Centre, Alabama
Jesse Holder	(504)582-4000	Freeport Sulphur, New Orleans
J. B. Sartin	(904)392-1804	U. of Florida, Soil Science Division
Jan Palatou	(202)331-9660	Sulphur Institute, Washington
Carl Johson	(202)861-4917	Fertilizer Institute, Washington
Mike Lloyd	(813)533-0983	Florida Institute of Phosphate Research
Dr. Malcom Sumner	(404)542-2461	U. of Georgia, Agronomy Division
Dr. Stu Pettigrove	(916)752-2533	U. of Cal. at Davis, Soil & Plant Division
Karen Simmons	(608)263-3878	U. of Wisconsin, soil Science Division
Dr. Jim Oster	(714)787-5100	U. of Cal. at Riverside, Soil & Env. Division
Dr. Bill Wildman	(916)752-2532	U. of Cal. at Davis
Dr. John Letey	(714)787-5105	U. of Cal. at Riverside
Larry Davis	(202)634-1206	USBM Gypsum

State Agriculture Contacts:

Roy Howard	(603)271-2505	New Hampshire
Jeff Comstock	(802)828-2413	Vermont
James Cassidy	(617)727-3018	Massachussets
Ken Veit	(203)566-4276	Connecticut
Steve Volpe	(401)277-2781	Rhode Island

Other Contacts called (x) and not called:

Bill Johnson (x)	(413)243-0053	Lee Lime, Lee, Mass.
Robert Clark (x)	(207)289-3841	Federal Department of Agriculture, Maine
Terry Bagouin	(207)289-3891	State Department of Agriculture, Maine
NFLD Department of Agriculture	(709)772-5030	
Quebec Department of Agriculture	(418)463-2673	

BIBLIOGRAPHY

Adams. A.F.R. 1973. Sulphur on New Zealand Pastures-Effect of Rates and Form. Sulphur Institute Journal 9: 14-16.

Adams. A.F.R. 1981. Alleviating Chemical Toxicities: Liming Acid Soils, Modifying the Root Environment to Reduce Crop Stress. American Society of Agricultural Engineers. p.269-300.

Adams and Moore. 1983. Chemical Factors Affecting Root Growth in Subsoil Horizons of Coastal Plain Soils. Soil Sci. Soc. Am. J. 47: 99-102.

Allaway, Thompson. 1966. Sulfur in the Nutrition of Plants and Animals. Soil Science. V. 101, no. 4: 240-247.

Atlantic Provinces Agricultural Services Committee. 1984. Atlantic Soils Need Lime. Pub. no. 534-84, Agdex no. 534.

Barber, S.A. 1967. Liming Materials and Practices. Soil Acidity and Liming. Pearson + Adams 12: 125-161.

Beaton and Fox. 1971. Sulfur Products. Fertilizer Technology and Use. 2nd Edition. Soil Sci. Soc. Am. 1971.

Beaton and Wagner. 1985. Sulphur-A Vital Component of Maximum Economic Yield Systems. Sulphur in Agriculture. 9: 2-8.

Biron. 1973. Coal as a Fertilizer. Cento Symposium on the Mining and Beneficiation of Fertilizer Minerals, Istanbul. 1973 p. 304-328.

Brydon and Heystek. 1958. A Mineralogical and Chemical Study of the Dikeland Soils of Nova Scotia. Canadian Journal of Soil Science. Vol. 38: 171-186.

Chauhan and Chauhan. 1979. A Modification to Schoonover's Method of Gypsum Requirement Determination of Soil. Aust. J. Soil Res. 17: 367-370.

Chauhan and Chauhan. 1984. Contribution of Soluble Carbonate Plus Bicarbonate to the Gypsum Requirement of Soil. Soil Science, Vol. 137 no. 3: 68-71.

Coleman and Thomas. 1967. The Basic Chemistry of Soil Acidity. Soil Acidity and Liming. Pearson + Adams 12: 1-41.

Dutt, Terkeltoub, and Rauschkolb. 1971. Prediction of Gypsum and Leaching Requirements for Sodium-Affected Soils. Soil Science, Vol 114, No. 2: 93-99.

Fisher and Black. 1983. Do You Really Know Your Fertilizers? Farm Chemicals. March 83: 68-71.

Fixen and Walworth. 1981. Sulfur in Potato Production in Wisconsin. The Badger Common 'Tater. June 1981: 34-37.

Fowler, D. 1977. Dry Deposition of SO_2 on Agricultural Crops. Proceedings of the International Symposium on Sulfur in the Atmosphere 1977 p. 369-373.

Freney, Randall and Spencer. Diagnosis of Sulphur Deficiency in Plants. Commonwealth Scientific and Industrial Research Organization. p. 439-444.

Golden. 1982. By-Product Gypsum Improves Sugarcane Stubble Yield. Better Crops with Plant Food. Vol LXVI: 18-20.

Groves, A. 1958. Gypsum and Anhydrite. Overseas Geological Surveys Mineral Resources Division p. 13-18.

Gupta and MacLeod. 1984. Effect of Various Sources of Sulfur on Yield and Sulfur Concentration of Cereals and Forages. Canadian Journal of Soil Science. Vol. 64: 403-409.

Guttridge, C. G. 1981. Calcium Deficiencies. The Badger Common 'Tater. June 1981: 31-33.

Hignett and Stangel. Agricultural Sulphur in the Americas. International Fertilizer Development Center.

Hinds, Ghanem. 1984. Effect of Gypsum on Yield of Kennebec - A Mid-Season Potato Cultivar. New Brunswick Dept. of Mines.

Hinds, R. P. 1983. High Limestone Applications on Eroded Podzols in New Brunswick. New Brunswick Dept. of Mines.

Jackson, W.A. 1967. Physiological Effects of Soil Acidity. Soil Acidity and Liming. Pearson + Adams 12: 43-78 (not complete).

Jennison, W. 1911. Gypsum as a Fertilizer. In Gypsum Deposits of the Maritime Provinces. Government Printing Bureau. p. 128-135.

Keren + Shainberg. 1981. Effect of Dissolution Rate on the Efficiency of Industrial and Mined Gypsum in Improving Infiltration of a Sodic Soil. Soil Sci. of Am. J. vol. 45:103-107.

Loveday, J. 1974. Recognition of Gypsum-Responsive Soils. Aust. J. Soil Res. 25: 87-96.

Loveday, J. 1976. Relative Significance of Electrolyte and Cation Exchange Effects When Gypsum is Applied to a Sodic Clay Soil. Aust. J. Soil Res. 14: 361-371.

Martini + Mutters. 1984. Effect of Liming and Fertilizationon Sulfur Availability, Mobility, and Uptake in Cultivated Soils of South Carolina. Soil Science 138: 403-410.

Oates + Kamprath. 1985. Use of By-product Gypsum to Alleviate Soil Acidity. Soil Scientists Society of American Journal vol. 49: 915-919

Oster + Tanji.1985. Chemical Reactions Within Root Zone of Arid Zone Soils. Journal of Irrigation and Drainage Engineering vol.III #3: 207-217.

Phosphorus and Potassium #13. The Utilization of Phosphogypsum in Agriculture. May/June, 1981.

Rhue and Kamprath. 1973. Leaching Losses of Sulfur During Winter Months When Applied as Gypsum, Elemental S or Prilled S. Agronomy Journal. Vo. 65: 603-605.

Safley, Nelson, Westerman. 1983. Conserving Manurial Nitrogen. Transactions of the ASAE-1983: 1166-1169.

Shainberg + Letey. 1984. Response of Soils to Sodic and Saline Conditions. Hilgardia vol.52 #2.

Shanmuganathan and Oades. 1983. Modification of Soil Physical Properties by Addition of Calcium Compounds. Aust. J. Soil Res. 21: 285-300.

Sharma, Fehrenbacher and Jones. 1974. Effect of Gypsum, Soil Disturbance and Tile Spacing on the Amelioration of Huey Silt Loam, a Natric Soil in Illinois. Soil Sci. Soc. Amer. Proc. Vo. 38: 628-632.

Simmons, Kelling and Kelman. 1985. Use of Supplemental Calcium on Potatoes. Reprinted from Wisconsin Fert., Aglime and Pest Mgmt. Conf. Proc. 1985 24: 63-73.

Singh, S. 1984. Increase in Neutral Salt Extractable Cation Exchange Capacity of Some Acid Soils as Affected by CaSo4 Applications. Canadian Journal of Soil Science Vo. 64 #2: 153-161.

Smith and Peterson. 1984. How Rapidly Do Potassium, Sulfate and Chloride Move Through the Soil? Better Crops With Plant Food. Vo. LXVI: 26-29.

Suarez and Jones. 1982. Soil Fertility and Plant Nutrition (Atmospheric Sulfur as Related to Acid Precipitation and Soil Fertility). Soil Sci. Soc. Am. J. Vol. 46: 976-980.

Sumner, Miller, Radcliffe and McCray. 1983. Use of Phosphogypsum as an Amendment for Highly Weathered Soils. U of Georgia, Athens.

Thompson and Troeh. 1978. Soils and Soil Fertility. 4th Edition. McGraw-Hill Book Company. p 200-204, 309-317.

Tisdale and Nelson. 1966. Soil Fertility and Fertilizers. MacMillan Co. p. 273-279.

Webster, D. 1981. Response of Bearing Cortland Apple Trees to Annual Surface Dressings of Fine and Coarse Gypsum. Agriculture Canada Research Center, Kentville, Nova Scotia.

Weeks + Lathwell. 1967. Crop Response to Lime in the Northeastern United States. Soil Acidity and Liming 12: 233-259.